FIBOCOM
Perfect Wireless Connection

H330S LGA Serials Module Hardware User Manual

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Versions

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V1.0.0	2013-05-14	Initial Version
V1.0.1	2015-03-17	Update the temperature range
V1.0.2	2015-04-21	Add the description of “Top View” in PCB Layout
V1.0.3	2015-05-19	Update the translation of the whole document.

Applicability Type

No.	Type	Note
1	H330S-Q50-00	
2		

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1 Foreword

1.1 Introduction

The document describes the electrical characteristics, RF performance, dimensions and application environment, etc. of H330S series wireless communication modules. With the assistance of the document and other instructions, developers can quickly understand the performance of H330S series wireless communication modules and develop products.

1.2 Reference Standards

The design of the product complies with the following standards:

- 3GPP TS 27.007 -v6.9.0: AT command set for User Equipment (UE)
- 3GPP TS 27.005 -v6.0.1: Use of Data Terminal Equipment -Data Circuit terminating Equipment (DTE-DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
- 3GPP TS 23.040 -v6.9.0: Technical realization of Short Message Service (SMS)
- 3GPP TS 24.011 -v6.1.0: Point- to - Point (PP) Short Message Service (SMS) support on mobile radio interface
- 3GPP TS 27.010 -v6.0.0: Terminal Equipment to User Equipment (TE-UE) multiplexer protocol
- 3GPP TS 27.060 -v6.0.0: Packet domain; Mobile Station (MS) supporting Packet Switched services
- 3GPP TS 25.304-v6.10.0: User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode
- 3GPP TS 25.308 -v6.4.0: High Speed Downlink Packet Access (HSDPA); Overall description;Stage 2
- 3GPP TS 25.309 -v6.6.0: FDD enhanced uplink; Overall description; Stage 2
- 3GPP TS 23.038 -v6.1.0: Alphabets and language - specific information
- 3GPP TS 21.111 -v6.3.0: USIM and IC card requirements
- 3GPP TS 31.111 -v6.11.0 "USIM Application Toolkit (USAT)"
- 3GPP TS 45.002 -v6.12.0: Multiplexing and multiple access on the radio path
- 3GPP TS 51.014 -v4.5.0: Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM-ME) interface
- 3GPP TS 51.010 -1 -v6.7.0: Mobile Station (MS) conformance specification; Part 1: Conformance specification
- 3GPP TS 22.004 -v6.0.0: General on supplementary services
- 3GPP TS 23.090 -v6.1.0: Unstructured Supplementary Service Data (USSD); Stage 2
- 3GPP TS 24.008 v6.19, Mobile radio interface Layer 3 specification;

2 Product Overview

2.1 Description

H330S series modules are 3G wireless communication modules with high integration density, supporting GSM/GPRS/EDGE and UMTS/HSDPA/HSUPA/HSPA+.

2.2 Specifications

Specifications	
Operating Frequency Range	UMTS (WCDMA)：850/900/1900/2100 MHz
	GSM/GPRS/EDGE：850/900/1800/1900 MHz
Data Rate	UMTS/HSDPA/HSUPA 3GPP release 7
	HSUPA 5.76Mbps (Cat 6)
	HSDPA 21Mbps (Cat 14)
	GSM 3GPP release 7
	EDGE (E-GPRS) multi-slot class 33(296kbps DL，236.8kbps UL)
	GPRS multi-slot class 33(107kbps DL，85.6kbps UL)
Physical Characteristics	Dimension: 33.8mm x 27.8mm x 2.45mm
	Interface: LGA
	Weight: <5.5 grams
Environment	Normal operating Temperature: -30℃ ~ +75℃
	Restricted operating temperature[1]: -40℃ ~ +85℃
	Storage Temperature: -40℃ ~ +85℃
Performance	
Operating Voltage	Voltage：3.3V ~ 4.5V　Normal：3.8V
Current Consumption (Typical Value)	2mA (Sleep Mode)
	3G Idle: 13mA
	3G Talk: 500mA

	2G Talk: 260mA (GSM PCL5)
Tx Power (Typical Value)	Class 4 (2W)：850/900 MHz, GSM
	Class 1 (1W)：1800/1900 MHz, GSM
	Class E2 (0.5W)：850/900 MHz, EDGE
	Class E2 (0.4W)：1800/1900 MHz, EDGE
	Class 3 (0.25W)：850/900/1900/2100 MHz, WCDMA
Rx Sensitivity (Typical Value)	UMTS/HSPA：-109dBm
	GSM：-108dBm
Interfaces	
Radio Frequency Interface	Main Antenna
	Diversity Antenna
Function Interface	1 x USB 2.0，2 x UART，MUX Over UART1，Multiple Profiles over USB
	SPI Support（暂不支持），I2C Support，I2S Support
	PCM，HSIC，GPIO，A/D，RTC
Data Features	
Protocol Stack	Embedded TCP/IP and UDP/IP protocol stack
EDGE	Multi-slot class 33 (5 Down; 4 Up; 6 Total)
	Coding Scheme MCS1~9
GPRS	Multi-slot class 33 (5 Down; 4 Up; 6 Total)
	Coding Scheme CS1~4
CSD	UMTS(14.4kbps)，GSM(9.6kbps)
USSD	Support
SMS	MO / MT Text and PDU modes
	Cell broadcast
Voice Features	Analog Audio and Digital Audio
	Voice coders: EFR/HR/FR/AMR

Audio Frequency Control	Gain Control, Echo Cancellation, Noise Suppression, Sidetone
Character Set	IRA，GSM，UCS2，HEX
AT Commands	FIBOCOM proprietary AT commands
	GSM 07.05
	GSM 07.07
Accessories	Firmware Loader Tool over USB/UART
	User Manual
	Developer Kit

Note[1]: For the temperature is out of the normal temperature range: -30℃ ~ +75, some indexes may slightly deviate from the related 3GPP codes.

2.3 Appearance

The product appearance of H330S series wireless module is shown as below:

Top view:

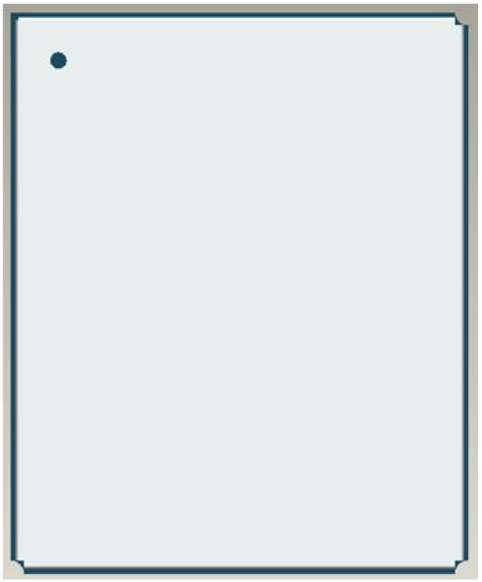


Figure 2- 1 Top View

Bottom view:

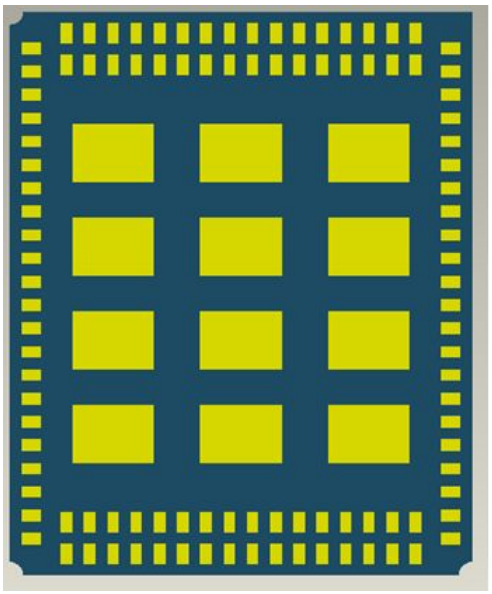


Figure 2- 2 Bottom View

3 Structure

3.1 Dimension Diagram of Structure

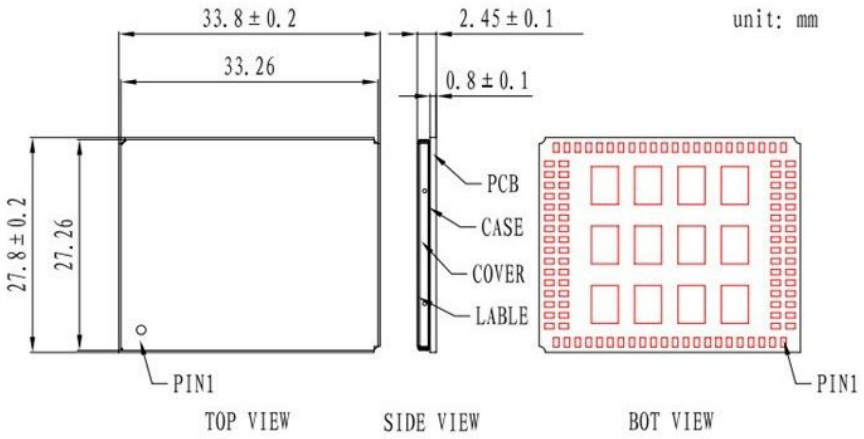


Figure 3- 1 Dimension Diagram of Structure

3.2 PCB Layout Design

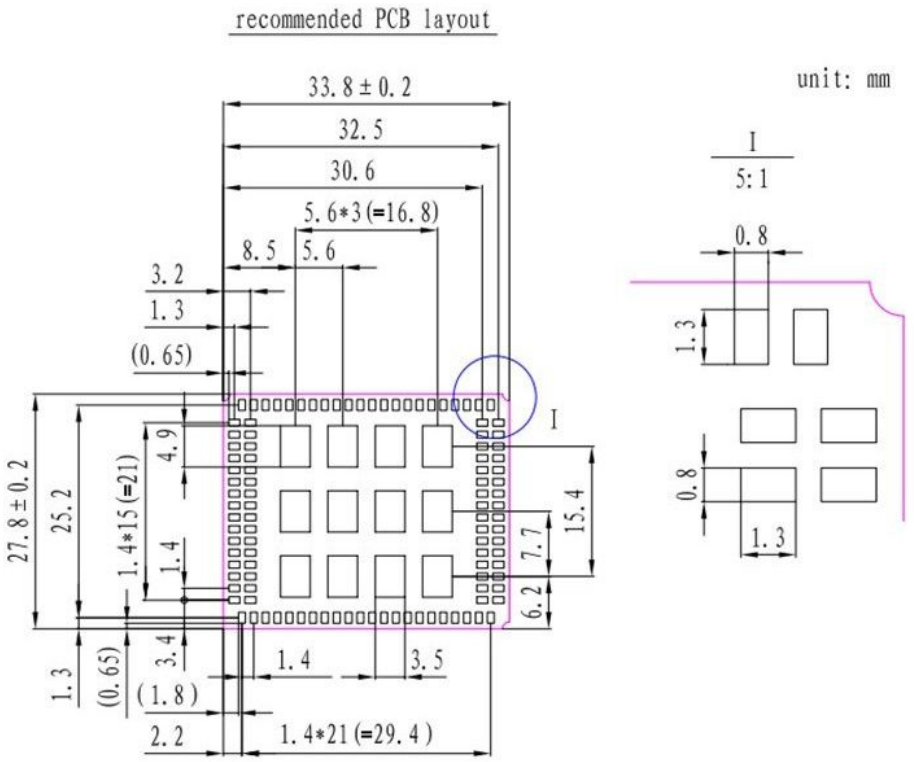


Figure 3- 2 Recommended PCB Layout

(Top View)

4 Hardware Introduction

4.1 Hardware Block Diagram

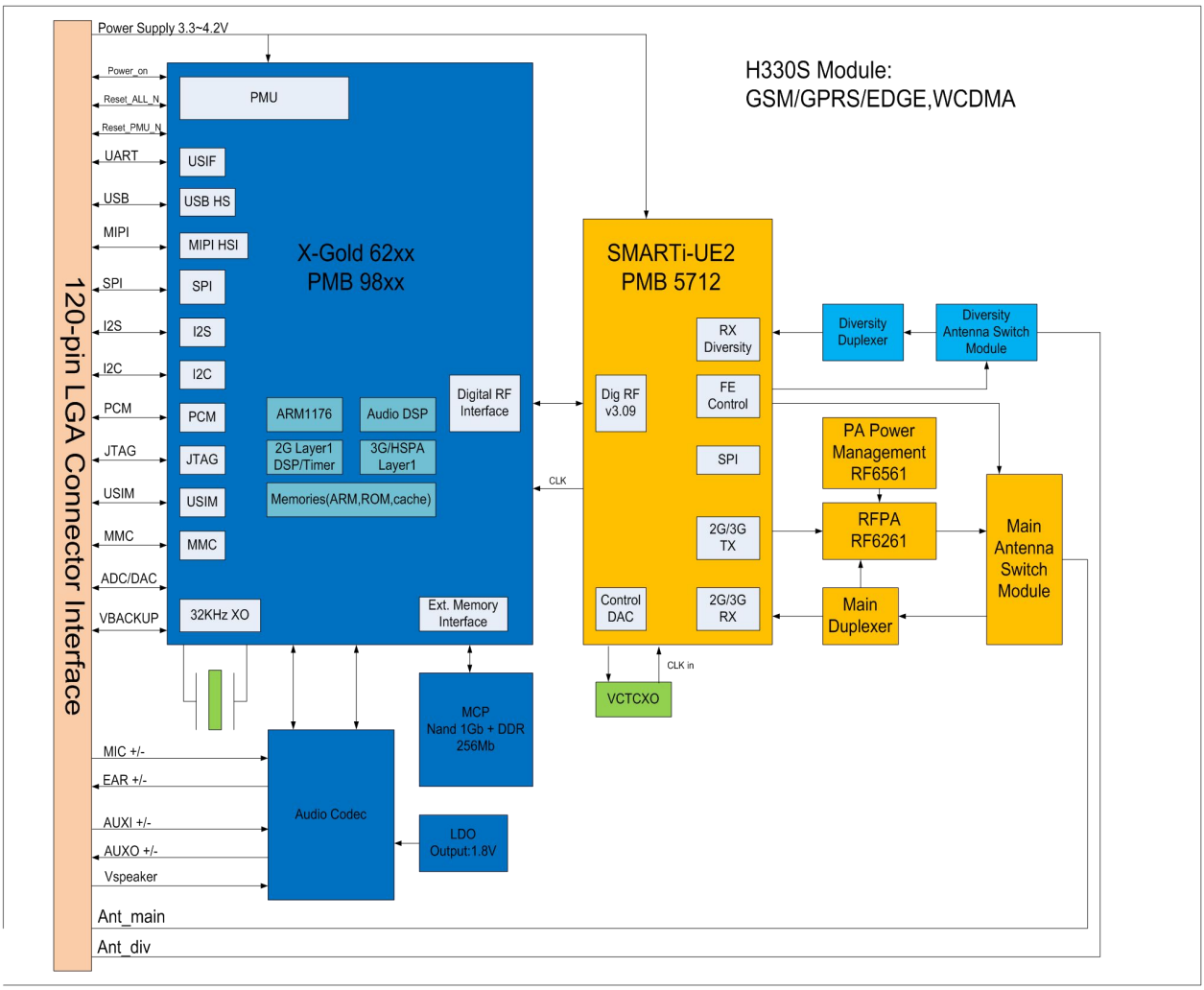
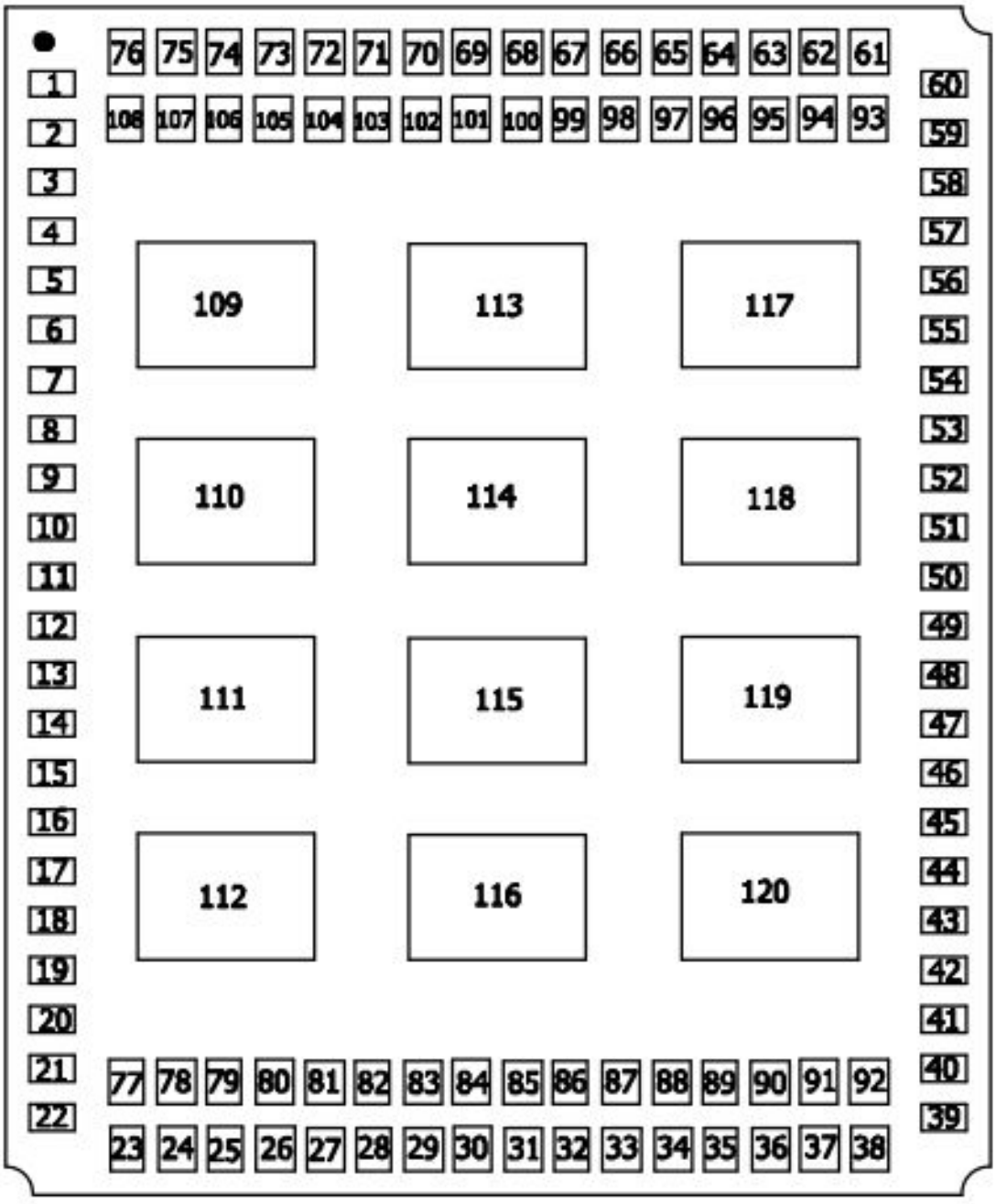


Figure 4- 1 Block Diagram

4.2 Pin Definition

4.2.1 Pin Map



TOP (View)

Figure 4-2 Pin Diagram

4.2.2 Description of Pins

The logic signal lever of H330S series is 1.8V. Pins of H330S series are described in the table below:

Pin #	Pin Name	I/O	Description
Power Supply			
59	VBAT	I	Main power supply, voltage range: 3.3V ~ 4.5V.
60	VBAT	I	
61	VBAT	I	
62	VBAT	I	
64	VPA	O	Test pin for power supply of RF power amplifier .Idle state in actual use.
1	VTRX	O	Test pin for transceiver power supply . Idle state in actual use
46	VIO	O	1.8V voltage output inside the modules.
47	VRTC	I/O	Backup battery input/output.
Power ON/OFF Signal			
48	POWER_OFF	I	Power off control signal
49	POWER_ON	I	Power on control signal
Reset Signal			
77	RESET_ALL_N	I	External reset signal input
USIM Interface			
4	USIM_CD	I	Insert USIM card to test; active low
5	USIM_VCC	O	USIM card power supply: 1.8V or 3.3V.
6	USIM_RST	O	USIM card reset signal.
7	USIM_CLK	O	USIM card clock signal.
8	USIM_DATA	I/O	USIM card data signal
High Speed SIM Interface			
9	USIM_D+		High speed SIM card USB signal + (Temporarily not supported)
10	USIM_D-		High speed SIM card USB signal - (Temporarily not supported)
Audio Interface			
13	AUXO+	O	Speaker output signal +

14	AUXO-	O	Speaker output signal -
15	EAR-	O	Earphone signal output -
16	EAR+	O	Earphone signal output +
17	MIC+	I	Main MIC input signal +
18	MIC-	I	Main MIC input signal -
19	AUXI-	I	Auxiliary MIC input signal -
20	AUXI+	I	Auxiliary MIC input signal +
21	AGND	GND	Analog GND
22	VSPK	I	Power supply input for the internal power amplifier of audio codec chip, Advise to connect VBAT.
I²S Interface			
11	I2S2_CLK1	O	I2S2 serial clock SCLK1
24	I2S2_CLK0	O	I2S2 serial clock SCLK0 (Default: CLK0)
25	I2S2_WA0	O	I2S2 field selection signal
26	I2S2_TX	O	I2S2 serial data output
27	I2S2_RX	I	I2S2 serial data input
USB Interface			
31	USB_DP	I/O	USB data signal+
32	USB_DM	I/O	USB data signal-
33	USB_ID	—	USB ID signal
34	VUSB	I	USB Power Input
92	USB_TEST	—	USB TEST signal
I²C Interface			
28	I2C_SDA	I/O	I2C data line
29	I2C_SCL	O	I2C clock line
UART1			
35	UART1_RI	O	UART1 Ring Indicator
36	UART1_DSR	I	UART1 DTE Ready
37	UART1_DTR	O	UART1 DCE Ready
38	UART1_DCD	O	UART1 Carrier Detect

39	UART1_CTS	I	UART1 Clear To Send
40	UART1_RTS	O	UART1 Request To Send
41	UART1_TXD	O	UART1 Transmitted Data
42	UART1_RXD	I	UART1 Received Data
UART2			
45	UART2_TXD	O	UART2 Transmitted Data
44	UART2_RXD	I	UART2 Received Data
ADC			
50	ADC2		ADC2(not supported yet)
51	ADC1		ADC1(not supported yet)
EINT			
56	WAKE_UP	I	Interrupt of external wake-up, active low.
57	EINT2	I	External interrupt, active low.
USB HSIC			
90	HSIC_USB_DATA		HSIC USB data signal line (not supported)
91	HSIC_USB_STRB		HSIC USB pulse signal line(not supported)
Antenna Interface			
67	ANT_MAIN	I	Main antenna interface,impedance requirement: 50 ohm.
71	ANT_DIV	I	Diversity antenna interface,impedance requirement: 50 ohm.
Others			
54	CLKOUT0	O	Digital audio clock output
89	SMI	I	Sleep Mode Indicator
86	LPG	O	Status indicator
NC			
3	NC		
23	NC		
55	NC		
52	NC		
53	NC		

73	NC		
74	NC		
75	NC		
76	NC		
78	NC		
79	NC		
80	NC		
81	NC		
82	NC		
83	NC		
84	NC		
85	NC		
87	NC		
88	NC		
94	NC		
95	NC		
96	NC		
101	NC		
105	NC		
106	NC		
107	NC		
108	NC		
GND			
2	GND		
12	GND		
30	GND		
43	GND		
58	GND		
63	GND		
65	GND		
66	GND		

68	GND		
69	GND		
70	GND		
72	GND		
93	GND		
97	GND		
98	GND		
99	GND		
100	GND		
102	GND		
103	GND		
104	GND		
109	GND		
110	GND		
111	GND		
112	GND		
113	GND		
114	GND		
115	GND		
116	GND		
117	GND		
118	GND		
119	GND		
120	GND		

H：High Voltage Level

L：Low Voltage Level

PD：Pull-Down

PU：Pull-Up

T：Tristate

OD：Open Drain

PP：Push-Pull

5 Hardware Interface

5.1 Power Interface

5.1.1 Power Supply

H330S modules require 3.3V~4.5V direct current power supply, which can provide the maximum GSM emission current of 2A.

Input power supply requirements:

Parameter	Minimum Value	Recommended Value	Maximum Value	Unit
VBAT	3.3	3.8	4.5	V

Points for attention in design:

1. Supply voltage fluctuation shall be lower than 300mV.

2. Minimum supply voltage drop shall be higher than 3.3V.

Filter capacitor of supply circuit is designed as follows:

Recommended capacitor	Application	Description
1000uF	Supply capacitance	Reduce power-supply fluctuation during phone call. The capacitance value bigger is better
10nF, 100nF	Digital signal noise	Filter the interference caused by clock and digital signals
8.2pF, 10pF	1800/1900/2100 MHz	Filter RF interference
33pF, 39pF	850/900 MHz	Filter RF interference

5.1.2 Power Consumption

Parameter	Description	Condition		Typical Value	Unit
I_{OFF}	RTC mode			60	uA
I_{IDLE}	Idle mode	GSM		13	mA
		WCDMA		13	mA
I_{SLEEP}	Low power mode	DRX	2	2	mA
		DRX	5	2	

		DRX	9	2	
$I_{GSM-RMS}$	GSM voice - 1 TX slot 1 Rx slot	GSM850 PCL	5	230	mA
			10	80	
			15	50	
			19	46	
		EGSM900 PCL	5	240	
			10	83	
			15	50	
			19	47	
		DCS1800 PCL	0	156	
			5	71	
			10	49	
			15	46	
		PCS1900 PCL	0	165	
			5	70	
			10	50	
			15	46	
$I_{GPRS-RMS}$	GPRS Class 33 - 4 TX slot 1 Rx slot	GSM850 PCL	5	355	mA
			10	216	
			15	108	
			19	94	
		EGSM900 PCL	5	383	
			10	225	
			15	108	
			19	94	
		DCS1800 PCL	0	259	

			5	180	
			10	103	
			15	95	
		PCS1900 PCL	0	266	
			5	182	
			10	103	
			15	95	
$I_{EGPRS-RMS}$	EGPRS Class 33 - 4 TX slot 1 Rx slot	GSM850 PCL	8	522	mA
			14	145	
			19	95	
		EGSM900 PCL	8	522	
			14	150	
			19	95	
		DCS1800 PCL	2	484	
			9	117	
			15	103	
		PCS1900 PCL	2	493	
			9	118	
			15	103	
$I_{GSM-MAX}$	Peak current During TX slot	GSM850 PCL	5	1655	mA
			10	473	
			15	193	
			19	148	
		EGSM900 PCL	5	1715	
			10	536	
			15	208	

			19	147	
		DCS1800 PCL	0	1050	
			5	464	
			10	199	
			15	138	
		PCS1900 PCL	0	1100	
			5	489	
			10	203	
			15	139	
$I_{WCDMA-RMS}$	WCDMA	Band5 (850)	24dBm	387	mA
			0dBm	127	
			-24dBm	121	
			-50dBm	119	
		Band2 (1900)	24dBm	439	
			0dBm	130	
			-24dBm	123	
			-50dBm	121	
		Band1 (2100)	24dBm	475	
			0dBm	131	
			-24dBm	121	
			-50dBm	119	
		Band8 (900)	24dBm	384	
			0dBm	127	
			-24dBm	123	
			-50dBm	121	

5.1.3 VIO

As the power supply for the digital circuit inside the module, VIO can be used as the status indicator for the module.

VIO can be used as the reference level of the module's digital signals.

Parameter	Minimum Value	Recommended Value	Maximum Value	Unit
VIO in operation	1.773	1.8	1.827	V

5.1.4 VRTC

VRTC is the power supply of the RTC inside the module, and it can be used as the backup power signal as well.

Parameters	Minimum Value	Recommended Value	Maximum Value	Unit
VRTC output voltage	1.71	1.8	1.89	V
VRTC input voltage (RTC is in normal)	0.5	1.8	1.89	V
VRTC input current (RTC is in normal)			1.5	uA

The reference design of VRTC circuit is as follows:

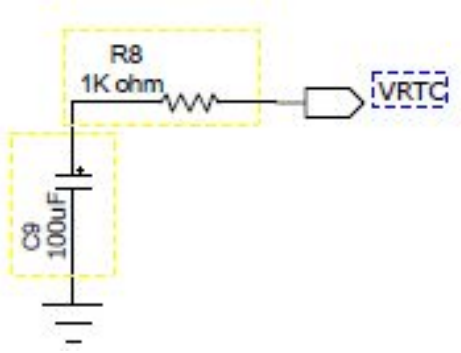


Figure 5- 1 VRTC Reference Design

Note:

- R8 is a current-limiting resistor, used to ensure the VRTC module works properly, free from being affected by peripheral circuits. R8≥1k ohm
- VRTC power consumption current<1uA
- The value of C9 will affect the retaining time of RTC after VBAT powers off. The retaining time of RTC can be roughly calculated by the following formula:
  T= (1.8-0.5)*C/1=1.3C, unit: second. Namely, if the value of C9 is 100uF, the retaining time of RTC will be around 130s.

5.2 Power on/off and Reset Signal

5.2.1 Pin Definition of Power on/off Control Signal

H330S wireless modules provide three control signals to start up, shut down, and reset the modules.

Pins definition as listed below :

Pin#	Pin Name	Electrical Level	Description
48	POWER_OFF	CMOS 1.8V	Power off signal
49	POWER_ON	CMOS 1.8V	Power on signal
77	RESET_ALL_N	CMOS 1.8V	External reset signal input

5.2.2 Power on Signal

After the module is connected to the power supply, the user can start up the module by setting low POWER_ON signal low.

Timing sequence requirement of the startup pulse:

Parameter	Condition	Minimum Value	Typical Value	Maximum Value	Unit
Pulse Width		100	300	3000	ms

The timing sequence control is shown in the diagram below:

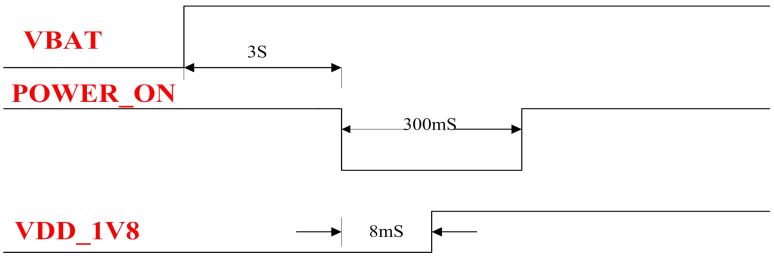


Figure 5- 2 Timing Control

The recommended design of POWER_ON signal is as follows:

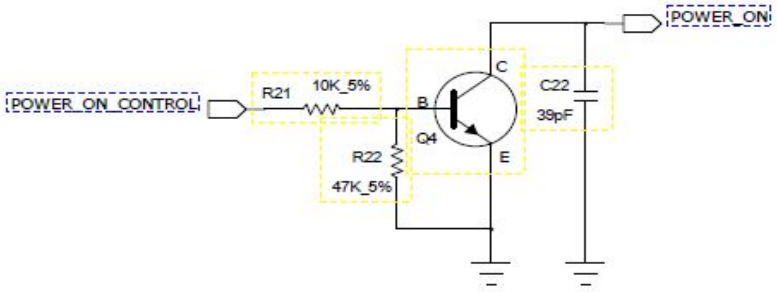


Figure 5- 3 POWER_ON Reference Design

5.2.3 Power off Signal

When setting POWER_OFF signal low, the module's PMU (Power Management Unit) will be reset. Then, the module will turn to shutdown state from operation state. The timing sequence requirements of the pulse are as follows:

Parameter	Condition	Minimum Value	Typical Value	Maximum Value	Unit
Pulse Width		100	300	3000	ms

The timing sequence control is shown in the diagram below:

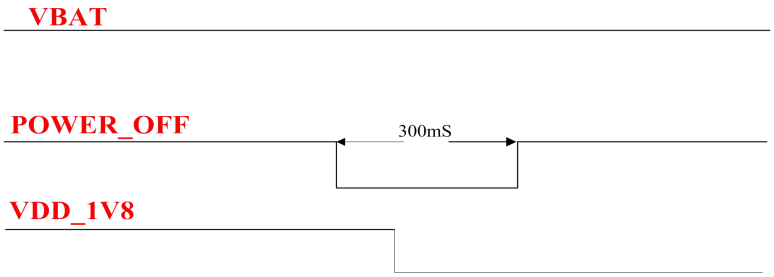


Figure 5-4 Timing Control

The recommended design of POWER_OFF signal is as follows:

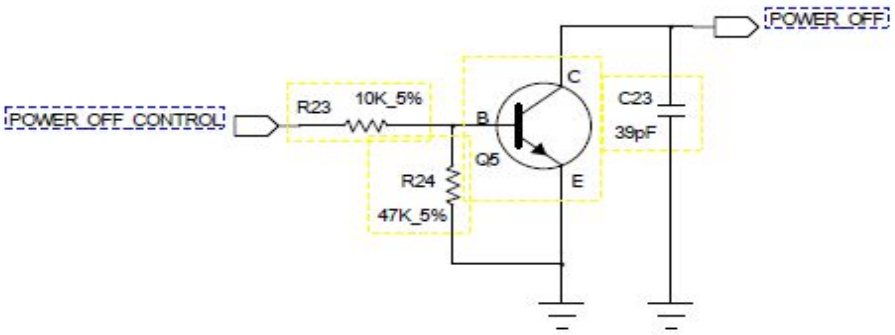


Figure 5-5 POWER_OFF Reference Design

5.2.4 Reset Signal

H330S wireless modules support external reset function. It is feasible to reset the module back to the original state by the Reset Signal.

When setting the Reset Signal low for 100ms, the module will be reset and restarted. When the user uses the Reset function, the PMU inside the module will not lose power.

Note: Reset signal is a sensitive signal line. In designing PCB layout, please keep the line away from RF interference, and make it well wrapped with ground wire. And it is advised to add an anti-shaking capacitor at the place close to the module end.

The timing sequence requirements of its pulse are as follows:

Parameters	Condition	Minimum Value	Typical Value	Maximum Value	Unit
Pulse Width		100	300	3000	ms

Recommended design:

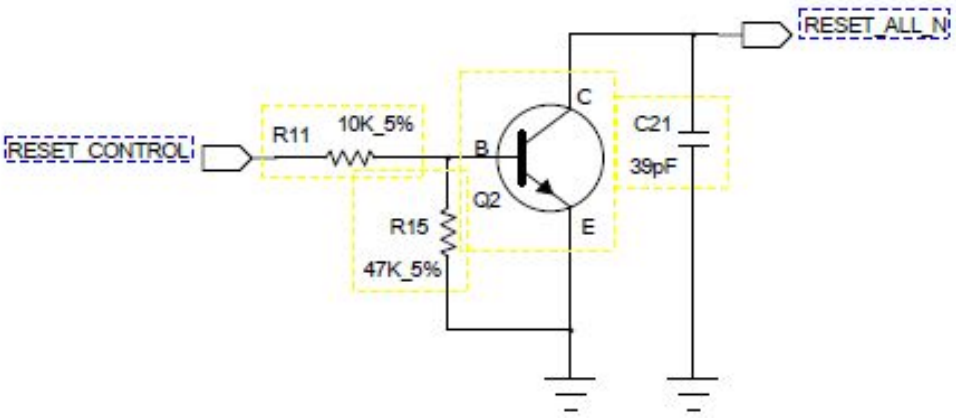


Figure 5- 6 Reset Recommended Design

5.3 Status Indicating Signal

5.3.1 Status Indicating Pin

Pin#	Pin Name	Description
86	LPG	Status indicating
89	SMI	Sleep Status indicating
56	WAKE_UP	Sleep wake-up pin
1	VTRX	Transceiver power supply signal, indicating the power status of the
64	VPA	Power supply signal of RF power amplifier

5.3.2 Description of Status Indicating Signals

5.3.2.1 LPG Signal

LPG signal description as listed below :

Status	Mode
idle(unregistered)	600ms high level, 600ms low level
idle(registered)	75ms high level, 3S low level
Voice communication (Call)	low level

Data communicating	75ms high level, 75ms low level
Sleep (sleep mode)	high level

Note: High level voltage is 1.8V.

5.3.2.2 SMI

Modes	Description
Sleep Mode	2.5S High; 100ms Low,repeat this
Other Mode	low level

5.3.2.3 WAKE_UP

Module Mode	WAKE_UP Signal	Description
Sleep	Low level	Wake up the module from Sleep mode to Idle mode
	High level	Keep the module in Sleep mode
Idle/Call	Low level	Keep the module in Idle/Call mode
	High level	The module cannot get into Sleep mode

5.3.2.4 Other Work Indications

Pin Name	Electrical Level	Description
VTRX	1.8V	Work indication of RF Transceiver PMU
VPA	0-4.3V	In transmission, output VCC; 0.65V at the lowest power; 4.3V at the largest power; 0V in the case of no transmission

Note: It is only used for indicating work conditions. Keep it in the idle state in actual use. It cannot be used for other purposes.

5.4 USB Interface

5.4.1 USB Interface Definition

Pin#	Pin Name	I/O	Description
31	USB_DP	I/O	USB signal+
32	USB_DM	I/O	USB signal-
33	USB_ID	—	USB ID signal (NC is recommended)

34	VUSB	I	USB power input
92	USB_TEST	—	USB TEST signal(NC is recommended)

H330S wireless modules support USB 2.0. Before connecting it to PC, it is necessary to install the related USB driver.

After inserting the H330S wireless modules to PC, the USB interface will work with the driver and map seven ports on PC, as follows:

- One 3G Modem/AT port for initiating data traffic
- Two ports for dispatching AT Command
- Two ports for capturing LOG information of the software
- Two port reserved for future use

5.4.2 USB Interface Application

Reference Circuit Design:

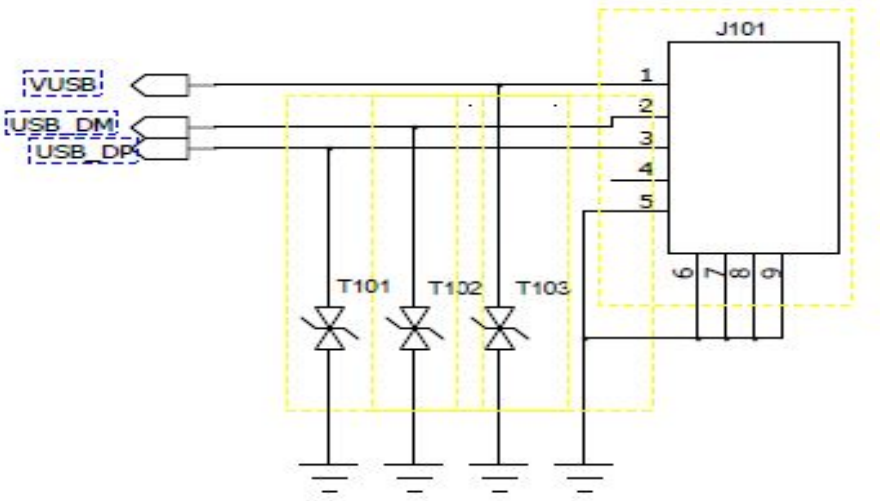


Figure 5-7 USB Interface Reference Circuit Design

T101 and T102 shall be TVS with capacitance lower than 1pF; there is no specific limitation for the capacitance of T103.

VUSB pin supplies power for USB. The recommended power supply range is 2.5V ~ 5.25V. In designing VUSB, there must be input, or it cannot recognize USB port.

USB_DP and USB_DM are the high-speed differential signal line, and their highest transmission rate is 480Mbps. The following requirements should be followed in designing PCB layout.

- USB_DP and USB_DM signal lines should have the same length, and should be parallel; avoid right angle wiring;
- USB_DP and USB_DM signal lines should be wrapped with GND at the ends.
- USB2.0 differential signal line should be laid at the signal layer closest to the ground layer.
- Ensure impedance matching; impedance is required to be 90ohm.

5.5 UART Interface

5.5.1 UART Interface Description

H330S wireless modules provide two UART for the users; one is standard 8-line serial port, and the other 2-line serial port.

The 8-line serial port UART1 supports full serial port mode with flow control function, and all the AT commands. Users can download software or receive and dispatch AT through UART1. The 2-line serial port UART2 only supports part of the AT commands.

Note: UART2 only supports the ordinary query function.

The definitions of UART1 and UART2 signal interfaces are as follows:

UART1			
Pin#	**Pin Name**	**I/O**	**Description**
35	UART1_RI	O	UART1 Ring Indicator
36	UART1_DSR	I	UART1 DTE Ready
37	UART1_DTR	O	UART1 DCE Ready
38	UART1_DCD	O	UART1 Carrier Detect
39	UART1_CTS	I	UART1 Clear to send
40	UART1_RTS	O	UART1 Request to send
41	UART1_TXD	O	UART1 Transmitted Data
42	UART1_RXD	I	UART1 Received Data
UART2			
Pin#	**Pin Name**	**I/O**	**Description**
44	UART2_RXD	I	UART2 Received Data
45	UART2_TXD	O	UART2 Transmitted Data

5.5.2 UART Interface Application

Connect UART1 of H330S wireless module (DCE) to PC, and the signal direction of (DTE) is as follows:

MCU (DTE) application	Signal Direction	H330S module (DCE)
RXD	←	UART1_TXD
TXD	→	UART1_RXD
RTS	→	UART1_CTS
CTS	←	UART1_RTS
DSR	←	UART1_DTR
DTR	→	UART1_DSR
RI	←	UART1_RI
DCD	←	UART1_DCD

Connect UART2 of H330S wireless module (DCE) to PC, and the signal direction of (DTE) is as follows:

MCU (DTE) application	Signal direction	H330S module (DCE)
RXD	←	UART2_TXD
TXD	→	UART2_RXD

Note: the high level of the module's UART interface is 1.8V. If it needs to connect it to 2.8V or 3.3V IO interface, it is necessary to switch the level.

In design: it is recommended to use SN74LVC2G07 to switch the level from 1.8V to 3.3V. During the communication between UART1 and PC, firstly raise the level from 1.8V to 3.3V, and then, employSP3238 to switch the level. During the communication between UART2 and PC, firstly raise the level from 1.8V to 3.3V, and then, employ SPIEX3232EEA to switch the level. Pay attention to the signal direction when switching the level.

5.5.3 Ring Indication

UART1_RI signal is used to indicate the incoming calls and SMS, and dispatch pulses to the host application.

Working mode	Status
No ringing	Low level
Ringing	1s high level, and 1s low level, repeat this.
No SMS	Low level
SMS	150ms pulse

5.6 USIM Interface

H33S series wireless modules support USIM and high speed SIM cards. For now, they do not support 8-line intelligent USIM.

5.6.1 USIM Pins

Pin#	Pin Name	I/O	Function Description
5	USIM_VCC	O	USIM power supply signal
6	USIM_RST	O	USIM Reset signal
7	USIM_CLK	O	USIM clock signal
8	USIM_IO	I/O	USIM data signal
12	GND	GND	USIM ground signal
4	USIM_CD	I	USIM Plug-in detection signal The internal module has been pulled up. High level indicates that SIM card is not inserted. Low level indicates that card is inserted.

5.6.2 USIM Design

Reference Circuit Design:

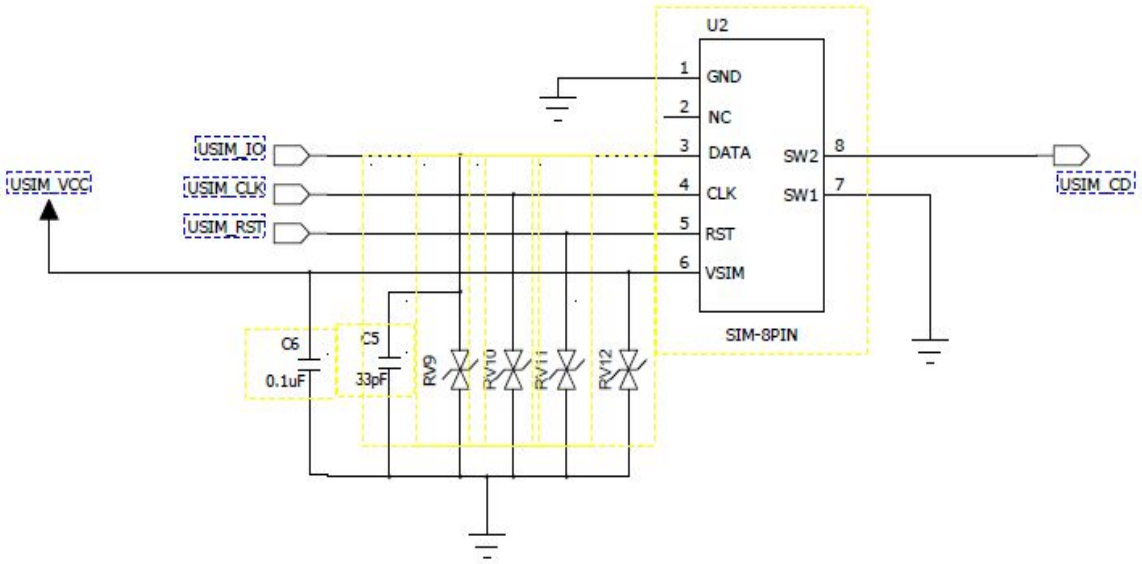


Figure 5- 8 USIM Interface Reference Circuit

Note:

- In order to improve EMC performance, the SIM card slot should be close to the module to the largest extent.

- The filter capacitor on the SIM-card signal circuit should be placed close to SIM card pin to the largest extent.
- ESD device (like TVS) shall be added to the SIM-card signal circuit protection. ESD device should be placed close to SIM card pin.
- USIM_IO has been pulled up inside the module. No need to pull it up again from the outside.
- USIM_CD signal connection supports hot-plugging; active low. If the module detects the signal at low level, it means there is a card in the module.

5.6.3 Points for Attention in USIM Design

SIM card interface design is very important for the normal operation of the module and SIM card.

The following points need to be complied with during the design:

- SIM card layout and wiring must keep away from EMI interference source, like RF antenna and digital switch signal.
- In order to ensure signal completeness, the wire distance between the module and SIM card should not exceed 100mm.
- In order to avoid mutual interference, USIM_CLK and USIM_IO signals should be separated in wiring. It would be best to wrap them with ground wire respectively.
- SIM card signal line should be protected with ESD. These protective devices should have small capacitance (like Zener diode, etc.). Users are recommended to select ESD devices with equivalent capacitance lower than 33pF. During layout, ESD device should be close to the SIM card interface.

5.6.4 USIM Hot-Plugging

H330S supports SIM card status-detection function. This function allows the hot-plugging of SIM card.

5.6.4.1 Hardware Connection

SIM card hot-plugging function needs to work with USIM_CD signal.

USIM_CD will be at high level without SIM card; after inserting SIM card, USIM_CD will be at low level.

In fig. 5-8, USIM_CD signal line is connected to U2's Pin8 (SW2), and Pin7 (SW1) is connected to the ground. When the SIM card is not inserted, SW2 will be at high level. When the SIM card is inserted, SW2 will be connected to SW1 and thus USIM_CD level will be pulled down.

5.6.4.2 Software Settings

"+MSMPD" configures AT command for the SIM card status-detection function.

If set AT+MSMPD=0, SIM card status-detection function will be closed, and the module will not detect USIM_CD signal.

If set AT+MSMPD=1, SIM card status-detection function will be in operation, and the module will detect if the SIM card is inserted by USIM_CD Pin.

If USIM_CD is at low level, which indicates SIM card is inserted, the module will automatically register it to the network.

If USIM_CD is at high level or unconnected, which indicates SIM card is not inserted, the module will not register it to the network.

Note: the default of +MSMPD parameter is “0”.

5.7 Analog Audio Interface

5.7.1 Definition of Audio Interface Signals

H330S wireless modules provide two channels of audio signal input and two channels of audio signal output.

Audio signal definition:

Pin#	Pin Name	I/O	Description
13	AUXO+	O	Audio channel 2 output signal +
14	AUXO-	O	Audio channel 2 output signal -
15	EAR-	O	Audio channel 1 earphone signal output -
16	EAR+	O	Audio channel 1 earphone signal output +
17	MIC+	I	Audio channel 1 MIC input signal +
18	MIC-	I	Audio channel 1 MIC input signal -
19	AUXI-	I	Audio channel 2 auxiliary MIC input signal -
20	AUXI+	I	Audio channel 2 auxiliary MIC input signal +
21	AGND	GND	Audio GND
22	VSPK	I	Power supply input for audio codec chip’s internal power amplifier Recommended to connect to VBAT

5.7.2 Description of Audio Interface Application

Audio input/output signals are differential signals that have good performance in anti-RF-interference. When connecting to the phone handle, it is not necessary to add audio power amplifier.

As to PCB layout, the wires should have the same length, and should be parallel and as short as possible. The wires should be wrapped with ground wire. The input and output signals should be separated by grounding. It would be best to add ESD protection to the audio signal port.

5.7.2.1 Audio Channel 1

Audio channel 1 is a differential audio port for calls through phone handle.

Audio channel 1: level features of MIC input interface

Parameters	Test conditions	Minimum Value	Typical Value	Maximum Value	Unit
Bias voltage	Without load		2.5	2.6	V
Gain	Programmable, stepping gain: 2dB	0		16	dB
Designed load impedance			2.2		Kohm

Audio channel 1: level features of EAR output interface:

Parameters	Test conditions	Minimum Value	Typical Value	Maximum Value	Unit
Output voltage	Without load			1.4	Vpp
Designed load impedance			32		ohm
DC Bias voltage			1		V

5.7.2.2 Audio Channel 2

Audio channel 2 is a differential audio port for applicable to hands-free calls. .

Note: Audio channel 2's downlink can only be used when VSPK power supply is normal. Generally, VSPK is connected directly to VBAT.

Audio channel 2: level features of AUXI input interface

Parameter	Test conditions	Minimum Value	Typical Value	Maximum Value	Unit
Bias voltage	No load		2.5	2.6	V
Gain	Programmable，steps gain:2dB	0		32	dB
Load resistance			2.2		Kohm

Audio channel 2: level features of AUXO output interface:

Parameter	Test conditions	Minimum Value	Typical Value	Maximum Value	Unit
Out voltage	No load			3.8	Vpp
Load resistance			8		ohm

5.8 Digital Audio

H330S supports digital audio I2S interface that supports normal I2S mode and PCM mode. I2S interface level is 1.8V on average.

I2S signal description:

Pin#	Pin Name	I/O	Description
24	I2S2_CLK0	O	Bit Clock
25	I2S2_WA0	O	Left and right channel clock (LRCK)
26	I2S2_TX	O	Serial data output
27	I2S2_RX	I	Serial data input
28	I2C_DATA	I/O	I2C control signal input/output
29	I2C_SCL	O	I2C control clock signal
54	CLKOUT0	O	26MHz main clock output

5.8.1 I2S

H330S	Signal Direction	Audio CODEC I2S Port
I2S2_CLK0	→	I2S_CLK
I2S2_WA0	→	I2S_LRCK
I2S2_RX	←	I2S_SDIN
I2S2_TX	→	I2S_SDOUT
CLKOUT0	→	I2S_MCLK

5.8.2 I2C

H330S	Signal Direction	Audio CODEC I2C Port
I2C_SDA	↔	I2C_SDA
I2C_SCL	→	I2C_SCL

Description:

- I2S interface can be configured as client-server work mode.
- Suitable for various audio sampling frequencies(48KHz, 44.1KHz, 32KHz, 24KHz, 22.5KHz, 16KHz, 12KHz, 11.025KHz and 8KHz).

5.9 Other Interfaces

The module does not support GPIO、MIPI、MMC、DAC ports yet.

6 Electrical and Environmental Features

6.1 Electrical Features

The table below lists the range of H330S's electrical characteristics:

Parameters	Minimum Value	Maximum Value	Unit
Power supply signal	0	4.2	V
Digital signal	0	1.9	V

6.2 Environmental Features

This table below shows the environmental features of H330S.

Parameters	Minimum Value	Maximum Value	Unit
Operational Temperature	-30	+75	°C
Restricted operating temperature[1]	-40	+85	°C
Storage Temperature	-40	+85	°C

Note[1]: for the temperature is out of the normal temperature range: -30℃ ~ +75, some indexes may slightly deviate from the related 3GPP codes.

7 RF Interface

There are small differences between different models. Please refer to the first table in chapter two.

7.1 Operating Frequency Band

7.1.1 Frequency Range of Main Antenna

Operating Band	Tx	Rx
UMTS 2100 (Band I IMT)	1920–1980 MHz	2110–2170 MHz
UMTS 1900 (Band II PCS)	1850–1910 MHz	1930–1990 MHz
UMTS 850 (Band V CLR)	824–849 MHz	869–894 MHz
UMTS 900 (Band VIII GSM)	880–915 MHz	925–960 MHz
GSM 850	824–849 MHz	869–894 MHz
GSM 900	880–915 MHz	925–960 MHz
DCS 1800	1710–1785 MHz	1805–1880 MHz
PCS 1900	1850–1910 MHz	1930–1990 MHz

7.1.2 Frequency Range of Diversity Antenna

Operating Band	Rx
UMTS 2100 (Band I IMT)	2110–2170 MHz
UMTS 1900 (Band II PCS)	1930–1990 MHz
UMTS 850 (Band V CLR)	869–894 MHz
UMTS 900 (Band VIII GSM)	925–960 MHz

7.2 RF PCB Design

7.2.1 Wiring Principle

Because H330S has no RF connector, the user needs to connect a length of RF line to the antenna, or design a connector on the board. So, it is recommended to use microstrip line for RF line. It should be as short as possible with loss controlled below 0.2dB, and impedance of 50 ohm.

Reserve a π circuit (the earth terminals of the two parallel devices should be directly connected to the main ground) between H330S module and the antenna connector (or feed point) for antenna tuning.

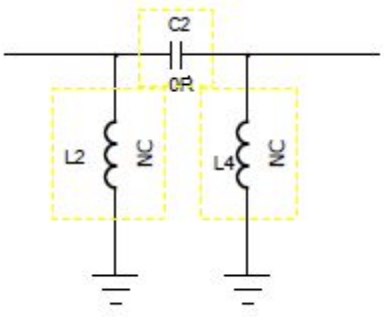


Figure 7- 1π-type Circuit

7.2.2 Impedance Design

The impedance of RF signal line of antenna interface needs to be controlled at 50 ohm.

7.3 Antenna Design

7.3.1 Main Antenna Design Requirements

(1) Antenna efficiency

Antenna efficiency is the ratio of the input power and radiant power. Because of the antenna's return loss, material loss and coupling loss, the radiant power is always lower than the input power. The ratio is recommended to be > 40% (–4dB).

(2) S11 or VSWR

S11 shows the matching degree of the antenna's 50 ohm impedance, which affects antenna efficiency to a certain extent. It is feasible to use VSWR testing method to measure the index. It is recommended that S11 < –10dB.

(3) Polarization

Polarization is the rotation direction of the electric field of the antenna at the direction of the largest radiation.

It is recommended to use linear polarization; for diversity antenna, it is recommended to use different polarization directions from that of the main antenna.

(4) Radiation pattern

Radiation pattern refers to the electromagnetic field intensity at various directions in the far field of the antenna. Half-wave doublet antenna is the perfect terminal antenna. In the case of built-in antenna, it is recommended to use PIFA.

- Antenna area: H 6mm * W 10mm * L 100mm. It is recommended to use PIFA or IFA.
- Antenna radiation direction: Omni-directional.

(5) Gain and directivity

Antenna directivity refers to the electromagnetic field intensity at various directions of the electromagnetic wave. Gain is the combination of the antenna efficiency and antenna directivity. It is recommended that antenna gain ≤ 2.5dBi.

(6) Interference

In addition to antenna performance, other interference from the PCB will also affect the module performance. In order to ensure the high performance of the module, the interference must be under control. Suggestions: keep speaker, LCD, CPU, FPC wiring, audio circuit, and power supply away from the antenna; add appropriate separation and shielding devices, or conduct filtering on the path.

(7) TRP/TIS

TRP (Total Radiated Power):

- W850/W900/W1900/W2100>19dBm
- GSM850>28dBm
- GSM900>28dBm
- DCS1800>25dBm
- PCS1900>25dBm

TIS (Total Isotropic Sensitivity) :

- W850/W900<-102dBm
- W1700/W1900/W2100<-103dBm
- GSM850<-102dBm
- GSM900<-102dBm
- DCS1800/PCS1900<-102dBm

7.3.2 Diversity Antenna Design

H330S series' diversity reception function is optional. If selected, it needs to add diversity antenna.

The design method of diversity antenna is the same as the main antenna. Its efficiency index is allowed to decrease by 3dB.

The isolation between the main antenna and the diversity antenna should be larger than 12dB.